# December 2011 MSS/LPS/SPS Joint Subcommittee Meeting
# ABSTRACT SUBMITTAL FORM

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## ABSTRACT INFORMATION

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## MANAGEMENT APPROVAL

The individual below certifies that the required resources are available to present this paper at the above subject JANNAF meeting.

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# ABSTRACT SUBMITTAL FORM

## Unclassified Abstract

*(250-300 words; do not include figures or tables)*

Sub-scale water tests were undertaken to assess the viability of utilizing high resolution, high frame-rate digital video recordings of a liquid rocket engine turbopump axial inducer to characterize cavitation instabilities. These high speed video (HSV) images of various cavitation phenomena, including higher order cavitation, rotating cavitation, alternating blade cavitation, and asymmetric cavitation, as well as non-cavitating flows for comparison, were recorded from various orientations through an acrylic tunnel using one and two cameras at digital recording rates ranging from 6,000 to 15,700 frames per second. The physical characteristics of these cavitation forms, including the mechanisms that define the cavitation frequency, were identified. Additionally, these images showed how the cavitation forms changed and transitioned from one type (tip vortex) to another (sheet cavitation) as the inducer boundary conditions (inlet pressures) were changed. Image processing techniques were developed which tracked the formation and collapse of cavitating fluid in a specified target area, both in the temporal and frequency domains, in order to characterize the cavitation instability frequency. The accuracy of the analysis techniques was found to be very dependent on target size for higher order cavitation, but much less so for the other phenomena. Tunnel-mounted piezoelectric, dynamic pressure transducers were present throughout these tests and were used as references in correlating the results obtained by image processing. Results showed good agreement between image processing and dynamic pressure spectral data. The test set-up, test program, and test results including H-Q and suction performance, dynamic environment and cavitation characterization, and image processing techniques and results will be discussed.